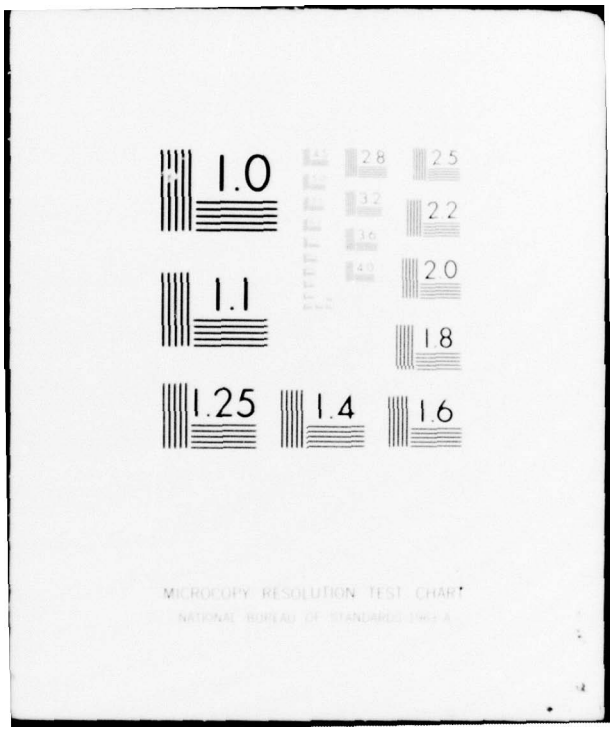
AD-A042 518 OFFICE OF NAVAL RESEARCH LONDON (ENGLAND) F/G 5/4
EUROPEAN SCIENTIFIC NOTES. VOLUME 7, NUMBER 2.(U)
JAN 53

UNCLASSIFIED NL

| OF |
AD
A042518

END
DATE FILMED
8-77
DDC


1.0
1.1
1.25
1.4
1.6
2.8
2.5
3.2
2.2
3.6
2.0
4.0
1.8
MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS 1963-A

OFFICE OF NAVAL RESEARCH

LONDON

EUROPEAN SCIENTIFIC NOTES

Volume 7, Number 2.

No. 7 - 2

15 January 1953

11 p.

Distributed by the Office of Naval Research
Washington 25, D. C,

AMERICAN EMBASSY LONDON, ENGLAND

265 000

OFFICE OF NAVAL RESEARCH
London

EUROPEAN SCIENTIFIC NOTES

15 January 1953 No. 7 - 2

AMERICAN EMBASSY LONDON, ENGLAND

OFFICE OF NAVAL RESEARCH
London

EUROPEAN SCIENTIFIC NOTES

15 January 1952 No. 7 - 2

MEASUREMENTS OF INTERPLANETARY DENSITIES OF ELECTRONS AND DUST PARTICLES

Professor H. Siedentopf of the University of Tübingen and Dr. A. Behr of the Fraunhofer Observatory, Freiburg, Germany, have carried out observations of the zodiacal light at the Jungfraujoch High Altitude Observatory at 3700 meters elevation.

Their equipment consisted of a 6 cm aperture telescope to which was attached a rotating polarizer. The receptor was a RCA 1P21 photomultiplier. A depolarizer was mounted in front of the photocathode. The signal from the photomultiplier was fed into parallel AC- and DC-amplifiers and the AC- and DC-portions were recorded separately. The AC-signal was, of course, due to the polarized portion of the zodiacal light. Using color filters, observations were made separately in the yellow and in the blue region of the spectrum. The equipment was calibrated for absolute light intensity with stars of known magnitude.

During observations conducted in February 1952, they set up their equipment to make automatic sweeps parallel to the horizon and extending from the horizon to an altitude of 20°. The results of the experiments can be represented as isophots for the general and polarized zodiacal light, and also for the counterglow ("Gegenschein") which was observed in these investigations. (The counterglow could not be seen visually.) In the plane of the ecliptic the polarization was found to be ~25 per cent.

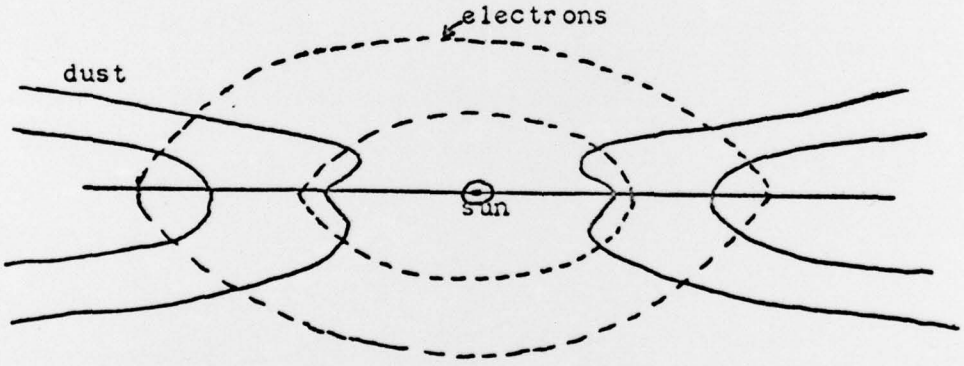
The analysis of the data was carried out under the assumption that the polarized part of the zodiacal light is produced only by electrons, while the unpolarized part is due to scattering by electrons as well as by dust particles; this procedure is justified by Mie's theory of scattering. The dust particles must be greater than 10^{-4}

cm, since otherwise they would be driven away from the vicinity of the sun by radiation pressure. However, the number with diameters greater than 10^{-3} cm should fall off rapidly, so that in the calculations an average diameter of 10^{-3} cm was assumed. The calculations also show a negligible polarization in the backward direction.

So far only the results from the "yellow" exposure have been analyzed. By solving the necessary integral equations, the following interplanetary electron densities are obtained in the plane of the ecliptic:

0.6 astron. units from the sun.....1000electrons/cc.
1.0 astron. units (at earth's orbit)... 600electrons/cc.
1.3 astron. units..... 120electrons/cc.

The distribution of surfaces of equal electron density is found to be ellipsoidal with a ratio of axes of two to one (see dotted lines sketch).



From the difference between the general and polarized component of the zodiacal light, information can be obtained about the distribution of interplanetary dust. Its density is found to be approximately constant in the plane of the ecliptic down to about the orbit of Venus and then drops rapidly towards the sun. If the dust particle diameter is assumed to be 10^{-4} to 10^{-3} cm, the density of interplanetary dust is found to be $\sim 10^{-15}$ particles/cc. This figure agrees well with the estimates of the coronal dust density by Allen and van de Hulst. The surfaces of equal dust particle density are also given in the sketch (by solid lines).

Siedentopf interprets the counterglow as produced by a cloud of particles rather than by anomalous scattering. In accordance with an old hypothesis, a high concentration of dust particles could exist in the vicinity of the libration point of the sun-earth system, approximately 0.01 astronomical units from the earth in the direction away from the sun. The particle density there would have to be 10 to 20 times that of the general field.

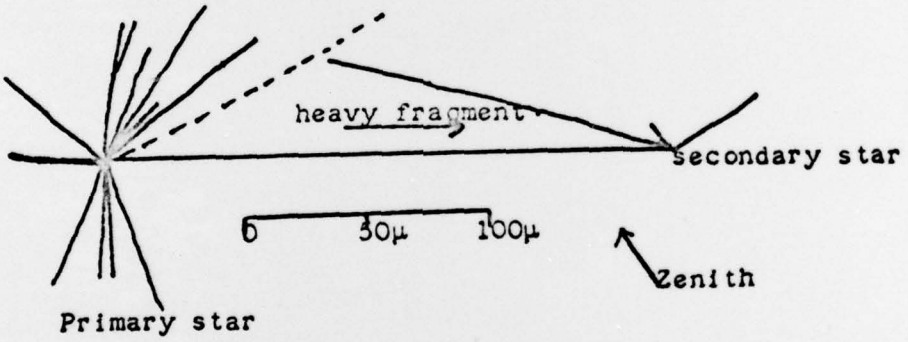
The full details of the present work will be published in the near future in the Zeitschrift für Astrophysik. Siedentopf and Behr are planning to continue these measurements with improved equipment at the Jungfraujoch.

COSMIC RAY STAR PRODUCED BY A SLOW NUCLEAR FRAGMENT

An unusual cosmic ray event has been observed by D.A. Tidman, G. Davis, and A.J. Hertz at Imperial College, London, in a G-5 nuclear emulsion exposed at high altitudes. An almost identical event was discovered a few weeks ago by Professor M. Danysz, University of Warsaw, who communicated its occurrence informally to the workers in England. The event found by the Imperial College group is described below.

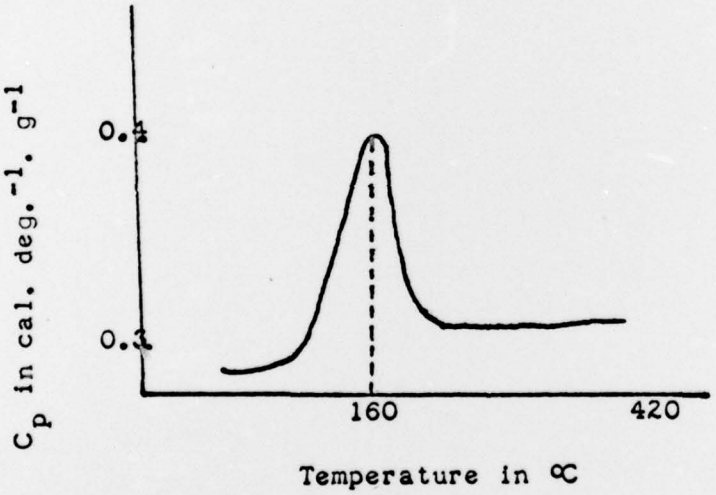
A large star was observed, produced by a primary proton of $\sim$6 Bev energy; the star showed no shower tracks but sixteen tracks above minimum ionization. One of the ejected particles was seen to cause another star on coming to rest. This particle had an initial charge of about ten as determined from the thinning down of its track. Its track length was about 250 microns. Its initial energy was estimated to be about 280 Mev. At the point at which it comes to rest, a three-prong star is observed; the total energy showing in the star is 50 to 70 Mev. (The event observed by Danysz showed a secondary star of even higher energy).

The time interval between ejection and stopping of the nuclear fragment ($\sim 10^{-11}$ sec) is too long to be ascribed to a metastable state. The probability of a chance coincidence (using both observations) is $\sim 10^{-8}$. In order to explain this event on some basis other than a chance coincidence, it is proposed by Danysz and by the Imperial College group that a π-meson produced in the primary star may have been carried along with the heavily-charged fragment and become absorbed only after the fragment came to rest. The energy released in such a reaction would be sufficient to account for the secondary star.



THE SPECIFIC HEAT OF LIQUID SULFUR

Professor H. Braune and Dr. Moeller (Hannover) have determined the specific heat of liquid sulfur over the temperature range 130 - 420°C. An adiabatic glass calorimeter was used in this experiment, which is a relatively difficult one due to the very small heat conductivity of liquid sulfur (only about ten times that of air). The temperature gradient between the center of the sample and the outside wall was 2 - 3°C. The temperature of the system was raised at rates which varied between 0.15 to 0.3° per minute. The absence of any systematic dependence of the measured specific heats on this rate indicates that equilibrium conditions were established. The precision of the results is estimated at ± 0.6 per cent. Approximately 100 determinations were made and the specific heat curve obtained is shown schematically below.



While interpretation of the results is difficult it should be noted that the maximum in the specific heat curve occurs at 160°C, i.e. at the temperature at which the viscosity just starts its well known precipitous rise ascribed to the transition of "monomeric" to "polymeric" sulfur.

This investigation forms a natural continuation of the recent work in this laboratory dealing with sulfur vapor. Their careful vapor density and absorption spectro-

scopic studies led to the fairly definite conclusion that the S_4 species makes a significant contribution to the composition of sulfur vapor. (cf. Z.f. Naturf., 6a. 32 (1951); 7a, 486 (1952)).

CATALYTIC DECOMPOSITION OF GASEOUS HYDROGEN PEROXIDE

Dr. A.B. Hart (Glasgow) is making a study of the vapor phase decomposition of hydrogen peroxide in the presence of various metal catalysts. The H_2O_2 vapor is passed at a low concentration in nitrogen through a constant temperature tube containing a single fine mesh gauze held normal to the direction of flow. The gas stream after passing the catalyst gauze is analyzed for H_2O_2.

His initial work has been directed towards a study of the kinetics of the reaction. A first order reaction was observed using as the catalyst a copper gauze slightly contaminated with boric acid. Similar results were also obtained with a sample of copper which had been electrolytically polished in the presence of phosphoric acid. However, a third sample of copper which was apparently uncontaminated showed zero order kinetics. At present Dr. Hart believes that the rate determining step is one of adsorption of peroxide on the metal surface, but this conclusion is very tentative and further experiments will be required before a thorough understanding of the kinetics may be obtained.

The changes of catalytic activity of various metals during exposure to hydrogen peroxide have also been measured. An initial decrease in catalytic activity is observed with silver and copper catalysts at low temperatures (80°C) which may be due to an increase in the thickness of the surface oxide layer. Following this initial decrease, the activity reaches a minimum value which lasts for a short time with copper but longer with silver and then rises slightly to a final steady value. The value of this activity is markedly dependent on temperature. With copper at 100°C the first two stages seen at lower temperatures are no longer evident but instead there is a rapid rise to a high level of activity. Cobalt was found to be an especially efficient catalyst for the heterogeneous vapor phase decomposition of peroxide. This seems rather unusual since cobalt is not a good catalyst in the solution decomposition of peroxide.

For further information on the heterogeneous decomposition of hydrogen peroxide see Technical Report ONRL-122-52, available from the Technical Publications Office, Office of Naval Research, Washington 25, D.C.

DIFFUSION IN LIQUID IRON

D. Morgan and J.A. Kitchener (Imperial College, London) have studied the diffusion of carbon and of cobalt in iron in the liquid state by using a radioactive technique. The diffusion experiments were conducted in tubes of small diameter (1.7 mm) to eliminate convection effects. The tube containing the diffusion couple with radioactive carbon or cobalt was heated to a temperature above the melting point of the solids and after diffusion had occurred, the specimen was solidified and a concentration-penetration curve was obtained. The latter was determined by measuring the radioactivity along the length of the specimen by using a slit system and a Geiger counter.

Values of the diffusion coefficient for carbon in iron were obtained at a series of temperatures (roughly 1400 - 1600°C) for carbon contents of 3.5, 1.0, and 0.1 per cent. These results as well as those for cobalt in iron (a couple of pure cobalt and pure iron) were all on the order of 5×10^{-5} cm^2/sec. The values ranged from $4 - 8 \times 10^{-5}$ cm^2/sec. depending upon temperature and composition.

The fact that the rate of diffusion of carbon in liquid iron is much the same as that for cobalt indicates that carbon does not diffuse as the Fe_3C molecule as proposed by others on the basis of surface tension measurements and other methods of studying the structure of liquids. Since this rate is not extremely high, some carbon-iron binding is evident, but the precise nature of this binding is not yet known.

The value of the activation energy for the high carbon and for the cobalt experiments was 13 ± 5 Kcal. The result predicted on the basis of Fraenkel's theory was 17 Kcal, while use of Eyring's theory gave 6 - 14 Kcal.

NEW TREATMENT OF CHRONIC MYELOID LEUKEMIA

A new drug "MYLERAN" (1:4-dimethanesulphonoxybutane), developed by Dr. G.M. Timmis of the Chester Beatty Institute, London, and produced by Burroughs Wellcome and Co., has been undergoing favorable clinical trials in the treatment of patients with chronic myelogenous leukemia. The drug is more selective than nitrogen mustard or the folic acid antagonists in its effect on myeloid cells and should be somewhat safer in its use.

The most favorable effects are a rise in the hemoglobin level, a selective reduction or even disappearance of immature myeloid cells from the blood, a reduction in the cellularity of the bone marrow, a diminution in the size of the enlarged spleen, and pronounced subjective improvement. The drug is of no value in the treatment of acute myeloblastic, lymphoblastic, or monocytic leukemia, or in acute relapse of the chronic leukemias.

In the small oral doses administered daily where depression of myeloid tissue is evident, there is little effect upon the lymphocytes and platelets, and side effects are absent. Larger doses, however, depress the platelet count, cause hemorrhagic symptoms, and there is a danger of producing an irreversible depression of the marrow which may not become obvious for 4 to 6 months. These effects show the necessity for the most rigid hematologic controls.

Three papers are soon to be published in Lancet on the use of "MYLERAN" in Great Britain. The drug is not available commercially until further clinical trials have been completed.

PERSONAL NEWS ITEMS

Sir Frederic Charles Bartlett and Professor C.K. Ingold have been recommended by the Royal Society to receive the Royal Medals for this year. Sir Frederic was Professor of Experimental Psychology at Cambridge from 1931 until he retired this year. Professor Ingold has been Professor of Chemistry at University College (London) since 1930.

Professor Sir John Lennard-Jones, F.R.S., has accepted an invitation to become Principal of the University College of North Staffordshire in succession to the late Lord Lindsay of Birker. Since 1932 Sir John has been Plummer Professor of Theoretical Chemistry at Cambridge, and since 1947 he has been Chairman of the Scientific Advisory Council of the Ministry of Supply.

FORTHCOMING EVENTS

BUNSEN SOCIETY MEETING ON TECHNICAL REACTIONS

The main topic of the next general meeting of the Bunsen Society will be the physical chemical principles of technical reactions. The meeting is scheduled for 14 - 17 May 1953 in Duisburg, Germany. The six invited speakers

on this main topic include Professor D.A. Hougen, Wisconsin, and Dr. D.W. van Krevelen, Holland.

Shorter contributions to this meeting, which may deal with physical chemical problems including those not related to the main topic, will be welcome.

Prepared by the Scientific Staff
Submitted by Dr. S.R. Aspinall
Deputy Scientific Director

Philip D. Lohmann

PHILIP D. LOHMANN
Captain, U.S.N.
Assistant Naval Attache for Research